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ELECTROCHEMICAL DATA

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by

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Electrochemical Data

I. Introduction

During the past period, the data on the electrolytic conductance of hydriodic acid were studied. Our literature search revealed that few papers have been published on the subject. The International Critical Tables (1929) cited two papers at 18°C, one by Loomis (1897) and the other by Heydweiller (1909). At 25°C, the work of Ostwald (1903), Washburn and Strachan (1913), and Strachan and Chu (1914) were cited. Ostwald's results were thrown in doubt when Bray and Hunt, JACS, 33, 786 (1911), showed that his data for hydrochloric acid were in error by about 3%. Washburn and Strachan's data were nullified by analytical errors made in establishing the concentrations of their solutions. This was rectified by the work of Strachan and Chu. Only three references to work on this subject were found that had not been listed in ICT. Two of these contain the same data, Hlasko and Wazewski, Bull. intern. acad. Polonaise, No. 4-5A, 181, (1928), and Hlasko, J. chim. phys., 26, 125, (1929). The third of these is that of Haase, Sauermann, and Dücker (1965).

II. Results

Table 1 gives the equivalent conductance at rounded concentrations in absolute mhos of hydriodic acid at 25°C. It is based on the best least squares fit of the data found in the following papers:

E. K. Strachan and V. G. Chu, JACS, 36, 810, (1914).

M. Hlasko, J. chim. phys., 26, 125, (1929).

R. Haase, P.-F. Sauermann and K.-H. Dücker, Z. physik. Chem. Neue Folge, 47, 3/4, 224, (1965).

Table 2 gives the equivalent conductance at rounded concentrations of hydriodic acid over a wide range of temperature. It is based on least squares fits of the data of Haase et al.

Table 3 lists interpolation formulas for use over the concentration ranges of Tables 1 and 2. The Λ_o values are derived from the limiting equivalent conductivities of the ions tabulated in Appendix 6.2, p. 465, of "Electrolyte Solutions," 2nd. Ed., Robinson, R. A. and Stokes, R. H., Butterworths, London, (1959). Values calculated from the ionic values at 0, 5, 15, 25, 35, 45 and 55°C were converted to absolute values and fitted by the computer, which then calculated the best values at 0, 10, 20, 25, 30, 40 and 50°C.

Table 4 contains the statistical details for the fits of the conductivity data at the various temperatures.

III. Other Halogen Acids

Data on hydrobromic and hydrofluoric acids are under study and will be reported on in subsequent reports.

TABLE 1 - Equivalent electrolytic conductance of hydriodic acid at 25°C

c	Λ	c	Λ	c	Λ
0.00045	423.2	0.0085	413.7	0.35	377.4
.00050	423.0	.0090	413.4	.40	374.9
.00055	422.9	.0095	413.1	.45	372.3
.00060	422.7	.010	412.8	.50	369.8
.00065	422.6	.015	410.3	.55	367.3
.00070	422.4	.020	408.3	.60	364.8
.00075	422.3	.025	406.6	.65	362.2
.00080	422.2	.030	405.2	.70	359.7
.00085	422.0	.035	403.9	.75	357.1
.00090	421.9	.040	402.8	.80	354.5
.00095	421.8	.045	401.7	.85	351.9
.0010	421.7	.050	400.8	.90	349.2
.0015	420.7	.055	399.9	.95	346.6
.0020	419.8	.060	399.1	1.0	343.9
.0025	419.1	.065	398.3	1.5	316.4
.0030	418.5	.070	397.6	2.0	288.9
.0035	417.9	.075	396.9	2.5	262.5
.0040	417.3	.080	396.3	3.0	237.9
.0045	416.8	.085	395.6	3.5	215.4
.0050	416.4	.090	395.1	4.0	195.1
.0055	415.9	.095	394.5	4.5	176.8
.0060	415.5	.10	394.0	5.0	160.4
.0065	415.1	.15	389.5	5.5	145.5
.0070	414.8	.20	385.9	6.0	131.7
.0075	414.4	.25	382.9	6.5	118.6
.0080	414.1	.30	380.1	7.0	105.7

TABLE 2 - Equivalent electrolytic conductance (Λ) of hydriodic acid

c	-20°C	-10°C	0°C	10°C	20°C	30°C	40°C	50°C
0.4	----	-----	253.9	300.7	354.5	411.9	453.6	501.8
0.6	----	-----	249.1	293.6	344.6	401.1	441.5	488.4
0.8	----	-----	242.4	285.5	333.9	389.1	429.3	474.8
1.0	----	-----	234.8	276.9	322.7	376.3	416.5	460.8
1.2	----	-----	226.6	267.9	311.4	363.1	403.4	446.3
1.4	----	-----	218.2	258.8	300.2	349.8	390.0	431.4
1.6	----	-----	209.9	249.7	289.1	336.6	376.5	416.3
1.8	----	-----	201.8	240.7	278.4	323.7	363.0	401.2
2.0	----	-----	194.0	231.9	268.1	311.1	349.6	386.1
2.2	----	147.7	186.6	223.4	258.2	299.0	336.3	371.2
2.4	----	143.5	179.5	215.1	248.8	287.3	323.3	356.5
2.6	----	138.8	172.8	207.2	239.7	276.1	310.5	342.2
2.8	----	133.9	166.5	199.5	231.0	265.4	298.1	328.2
3.0	99.9	129.0	160.5	192.0	222.7	255.1	286.1	314.7
3.2	97.4	124.1	154.7	184.8	214.6	245.2	274.5	301.7
3.4	94.2	119.5	149.1	177.8	206.7	235.7	263.4	289.2
3.6	90.6	115.0	143.7	171.0	198.9	226.4	252.6	277.3
3.8	86.9	110.9	138.3	164.3	191.2	217.4	242.3	266.0
4.0	83.6	106.9	132.8	157.6	183.5	208.4	232.5	255.3
4.2	80.9	103.0	127.3	151.0	175.6	199.6	223.1	245.3
4.4	79.3	99.2	121.6	144.3	167.5	190.7	214.1	235.9

TABLE 3 - Interpolation formulas

-20	$\Lambda = -188.5 + 268.0c - 79.17c^2 + 7.294c^3$
-10	$\Lambda = 55.399 + 157.67c - 82.804c^2 + 16.276c^3 - 1.1560c^4$
0	$\Lambda = 266.31 - 88.70c^{1/2} + 280.455c - 370.407c^{3/2} + 176.385c^2 - 29.2746c^{5/2}$
10	$\Lambda = 330.58 - 115.18c^{1/2} + 248.768c - 298.965c^{3/2} + 132.508c^2 - 20.8142c^{5/2}$
20	$\Lambda = 394.66 - 143.70c^{1/2} + 302.982c - 379.036c^{3/2} + 177.129c^2 - 29.2963c^{5/2}$
25	$\Lambda = 426.45 - 158.72c^{1/2} + 248.885c - 256.566c^{3/2} + 96.2195c^2 - 12.3887c^{5/2}$
30	$\Lambda = 457.93 - 174.20c^{1/2} + 370.263c - 445.069c^{3/2} + 198.665c^2 - 31.2569c^{5/2}$
40	$\Lambda = 519.72 - 206.42c^{1/2} + 317.597c - 312.945c^{5/2} + 112.255c^2 - 13.6656c^{5/2}$
50	$\Lambda = 579.38 - 240.28c^{1/2} + 354.327c - 331.163c^{5/2} + 110.209c^2 - 11.7132c^{5/2}$

TABLE 4 - Statistical Information

t°C	s	n	Standard Error
-20	0.07	5	0.03
-10	0.14	7	.05
0	1.05	15	.3
10	0.75	15	.2
20	1.63	15	.4
25	1.03	30	.2
30	1.14	12	.3
40	1.40	13	.4
50	2.38	13	.6